Enabling System Safety Through Technical Discipline

23rd International System Safety Conference
August 25, 2005

Mark D. Schaeffer
Principal Deputy Director, Defense Systems
Director, Systems Engineering
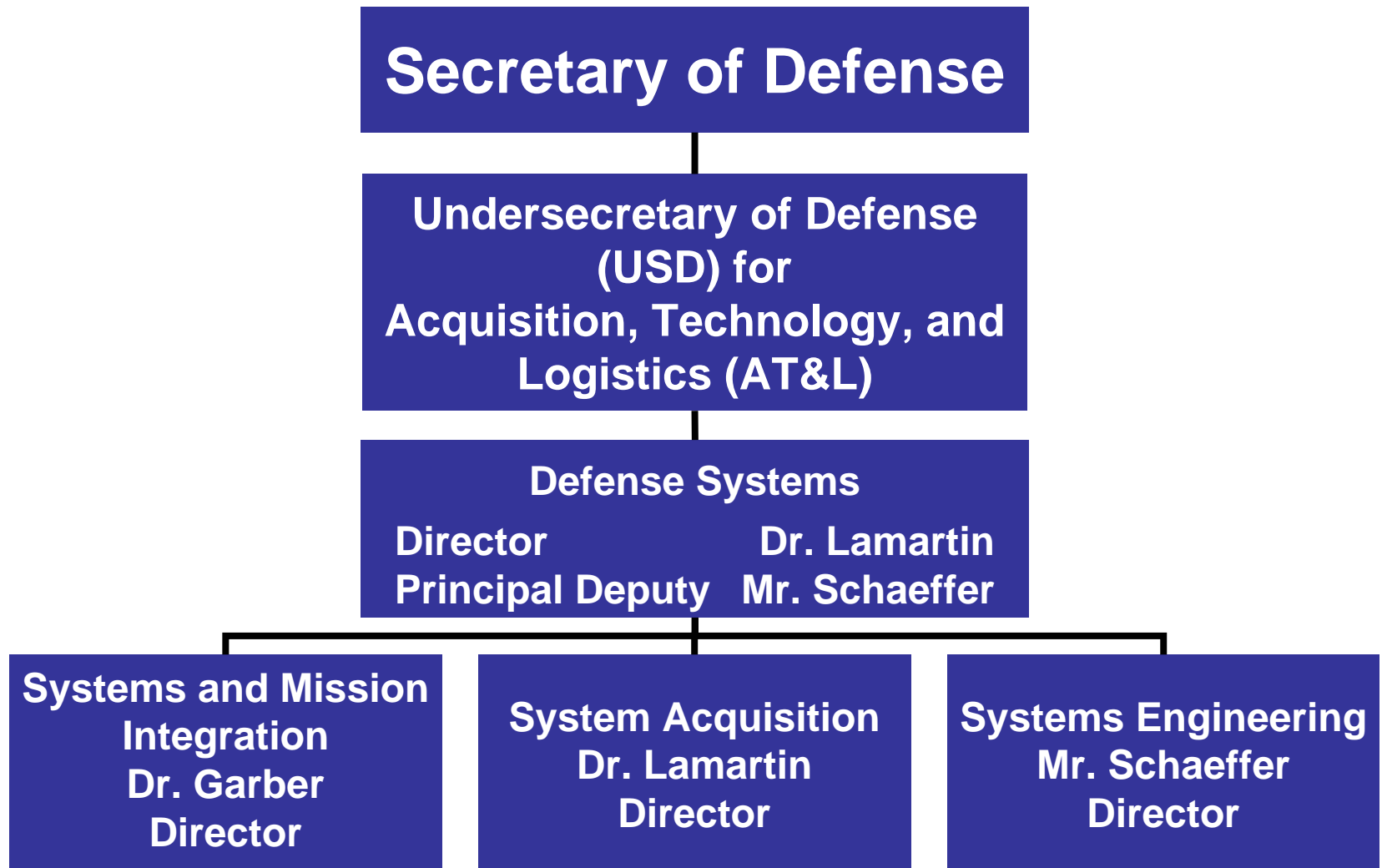**Office of the Under Secretary of Defense (AT&L)**

USD(ATL) Imperatives

- "Provide a context within which I can make decisions about individual programs."

- "Achieve credibility and effectiveness in the acquisition and logistics support processes."

- "Help drive good systems engineering practices back into the way we do business."

OSD Organization

Secretary of Defense

Undersecretary of Defense (USD) for Acquisition, Technology, and Logistics (AT&L)

Defense Systems

Director	**Dr. Lamartin**
Principal Deputy	**Mr. Schaeffer**

Systems and Mission Integration
Dr. Garber
Director

System Acquisition
Dr. Lamartin
Director

Systems Engineering
Mr. Schaeffer
Director

DoD Systems Engineering Shortfalls

- **Root cause of failures on acquisition programs include:**
  - **Inadequate understanding of requirements**
  - **Lack of Systems Engineering discipline, authority, and resources**
  - **Lack of technical planning and oversight**
  - **Stovepipe developments with late integration**
  - **Lack of subject matter expertise at the integration level**
  - **Availability of systems integration facilities**
  - **Incomplete, obsolete, or inflexible architectures**
  - **Low visibility of software risk**
  - **Technology maturity overestimated**

Major contributors to poor program performance

What We Have Done To Revitalize Systems Engineering

- **Issued Department-wide Systems Engineering (SE) policy**

- **Issued guidance on SE, T&E, and SE Plans (SEPs)**

- **Instituted system-level assessments in support of DAB, OIPT, DAES, and ad hoc reviews**

- **Established SE Forum to ensure senior-level focus within DoD**

- **Integrating DT&E with SE policy and assessment functions-- focused on effective, early engagement of both**

- **Instituting a renewed emphasis on modeling and simulation**

- **Working with Defense Acquisition University to revise curricula**

- **Leveraging close working relationships with industry and academia**

Necessary but not sufficient!

Driving Technical Rigor Back into Programs
"Portfolio Challenge"

- **For major acquisition programs (ACAT ID and IAM), Defense Systems was tasked to:**
  - Review program's SE Plan (SEP)
  - Review program's T&E Master Plan (TEMP)
  - Conduct Program Support Reviews (PSRs)

- **Across these domains:**
  - Business Systems
  - Communication Systems
  - C2ISR Systems
  - Fixed Wing Aircraft
  - Unmanned Systems
  - Rotary Wing Aircraft
  - Land Systems
  - Ships
  - Munitions
  - Missiles

Systems Engineering support to over 130 major programs in ten domains

Driving Technical Rigor Back into Programs
"Importance and Criticality of the SEP"

- **Program's SEP provides insight into every aspect of a program's technical plan, focusing on:**
  - **What are the program requirements?**
  - **Who has responsibility and authority for managing technical issues—what is the technical staffing and organization?**
  - **How will the technical baseline be managed and controlled?**
  - **What is the technical review process?**
  - **How is the technical effort linked to overall management of the program?**

- **Living document with use, application, and updates clearly evident**

> ***The SEP is fundamental to technical and programmatic execution on a program***

Driving Technical Rigor Back into Programs
"Importance of TEMP"

- **TEMP provides insight into adequacy of T&E planning:**
  - Are the scope and content of planned tests adequate?
  - Is the T&E program structured to support decisions at major milestones? Measure technical progress and maturity?
  - Are the schedule and resource requirements adequate?
  - Is DT&E program structured to achieve successful OT&E?

- **Living document that must reflect all major changes to a program**

The TEMP is fundamental to validating program maturity

Driving Technical Rigor Back Into Programs
"Program Support Reviews"

- **Program Support Reviews provide insight into a program's technical execution focusing on:**
  - SE as envisioned in program's technical planning
  - T&E as captured in verification and validation strategy
  - Risk management—integrated, effective and resourced
  - Milestone exit criteria as captured in Acquisition Decision Memo
  - Acquisition strategy as captured in Acquisition Strategy Report

- **Independent, cross-functional view aimed at providing risk-reduction recommendations**

The PSR reduces risk in the technical and programmatic execution on a program

Driving Technical Discipline

Topic	Systems Engineering	Test & Evaluation	Programmatic Risk Management	Exit Criteria	Acquisition Strategy
Focus Areas	**Requirements**	**V&V Traceability**	**Risk ID**	**Mission Systems**	**Mission Capability**
	Organization & Staffing	**Test Resources**	**Risk Analysis**	**Support**	**Resources & Management**
	Technical Reviews	**Test Articles**	**Risk Mitigation Planning**	**Manufacturing**	**Technical Process**
	Technical Baseline	**Evaluation**	**Risk Tracking**	**R & M**	**Technical Product**
	Linkage w/ Other Program Mgmt & Controls	**Linkage w/ Other Program Mgmt & Controls**	**Evidence of Effectiveness**	**Net Centric**	**Enterprise Environment**
Product	**SEP**	**TEMP**	**RM Plan**	**Phase Exit Criteria**	**ASR/APB**

Reducing Preventable Accidents

- **In FY 2002 DoD mishaps resulted in:**
  - **550+ active duty fatalities**
    - **308 were POV accidents**
    - **67 were aviation-related deaths**

    1 military death every 16 hours

  - **Over 1,474,000 military injury cases**
    - **348,683 cases with duty limitations**
    - **31,631 cases with hospitalization or quarters**
    - **91,448 days lost**

    168 active duty injuries every hour

  - **2.0 Class A Aviation accident rate**
    - **Losses valued at $1.8 billion**

    1 aircraft destroyed every 5.2 days

"*We need to turn this situation around.*"
SECDEF Memo, May 19, 2003

Defense Safety Oversight Council Governance Role

- **Ensure personal involvement of senior leadership**

- **Promote the 50% accident reduction effort to all levels of military and civilian leadership**

- **Execute the specific initiatives to reduce accidents and time lost due to injuries**

- **Garner the resources to support the initiatives**

- **Manage progress toward goal**

- **Provide periodic updates to the Secretary**

DSOC Membership

- **Principal Members**
  - Under Secretary of Defense for Personnel and Readiness (as Chair)
  - Under Secretary of Defense for Acquisition, Technology, and Logistics
  - Under Secretary of Defense (Comptroller)/Chief Financial Officer
  - Vice Chairman of the Joint Chiefs of Staff
  - Assistant Secretary of Defense for Health Affairs
  - Under Secretary of the Army
  - Under Secretary of the Navy
  - Under Secretary of the Air Force

- **Associate members**
  - Deputy Under Secretary of Defense (Installations and Environment)
  - Deputy Under Secretary of Defense (Readiness)
  - Deputy Under Secretary (Civilian Personnel Policy)
  - Deputy Inspector General of the Department of Defense
  - Deputy Assistant Secretary of Defense (Clinical and Program Policy)
  - Deputy Director (Administration & Management), OSD

- **Executive Secretary**
  - Joseph J. Angello, Jr., Director, Readiness Programming & Assessment

7

Improving Safety Performance

- **Eight DSOC Task Forces**
  - **Deployment and Operations**
  - **Aviation Safety Improvements**
  - **Military Training**
  - **Personal Motor Vehicle Accident Reduction**
  - **Installation and Industrial Operations**
  - **Worker's Compensation**
  - **Enterprise Information and Data**
  - **Acquisition and Technology Programs (ATP)**

Acquisition and Technology Programs (ATP) Task Force

- **Purpose**
  - **Recommend or implement changes to policies, procedures, initiatives, education and training, and investments to ensure programs address safety throughout the life cycle**

- **Goals**
  - **Ensure acquisition policies and procedures for all systems address safety requirements**
  - **Review and modify, as necessary, relevant DoD standards with respect to safety**
  - **Recommend ways to ensure acquisition program office decisions consider system hazards**
  - **Recommend ways to ensure milestone decision reviews and interim progress reviews address safety**

Establish dialogue between System Safety and Systems Engineering communities

14

How the ATP Task Force Has Responded

- **Issued DoD-wide policy on "Defense Acquisition System Safety" (USD(AT&L) Memo, Sep 23, 2004)— Program Managers shall:**

  - **Integrate system safety risk management into their overall systems engineering and risk management processes**

  - **Use Standard Practice for System Safety, MIL-STD-882D, in all developmental and sustaining engineering activities**

  - **Ensure the Environment, Safety, and Occupational Health (ESOH) risk management strategy is integrated into the SE process and incorporated in the Systems Engineering Plan**

  - **Identify ESOH hazards, assess the risks, mitigate the risks to acceptable levels, and report status of residual risk decisions at appropriate program reviews per MIL-STD-882D**
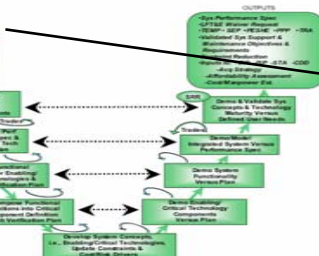
Program Support Reviews
System Safety Metrics

- **Developing evaluation criteria for System Safety**
  - **Emphasizing effective integration into Systems Engineering**
  - **Focused on assessing performance of System Safety**
    - **Identifying environment, safety, and occupational health hazards**
    - **Influencing design development to eliminate or mitigate hazards**
- **Integrating System Safety into Defense Acquisition Executive Summary (DAES) quarterly reporting**
  - **Piloting with DAES-Sustainment**
  - **Four System Safety Metrics for Sustainment phase**
    - **Hazard with highest risk category**
    - **Class A, B, and C mishap rate trends**
    - **Open Safety or Hazardous Material technical data change requests**
    - **System Safety level-of-effort**

SE in the System Life Cycle "The Wall Chart"

Integrated Defense Acquisition, Technology, & Logistics Life Cycle Management Framework

# System Safety in SE Process Technology Development Phase

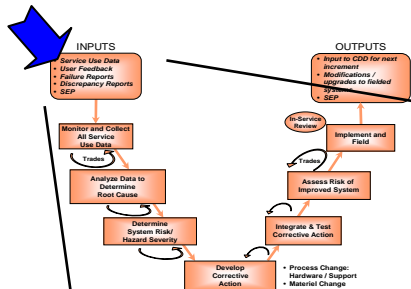| Inputs	System Safety Should:
Initial Capabilities Document (ICD) and Draft Capability Development Document (CDD)	Develop system safety criteria and requirements
Preferred System Concept	Evaluate system concept against identified system safety criteria
Exit Criteria	Provide the following exit criteria: 1. Update Preliminary Hazard List (PHL) 2. Update strategy for integrating Environment, Safety, and Occupational Health (ESOH) risk management into systems engineering (SE)
Test and Evaluation (T&E) Strategy	1. Incorporate hazard risk mitigation test and verification methodologies 2. Provide approach toward obtaining safety release(s)
Support and Maintenance Concepts and Technologies	Provide inputs as requested
Analysis of Alternatives (AoA)	Characterize ESOH footprints or risks for AoA development
Systems Engineering Plan (SEP)	Update strategy for integrating ESOH risk management into SE
Technology Development Strategy (TDS)	1. Include strategy to identify hazards 2. Identify needed ESOH technology development

SE in the System Life Cycle "The Wall Chart"

Integrated Defense Acquisition, Technology, & Logistics Life Cycle Management Framework

19
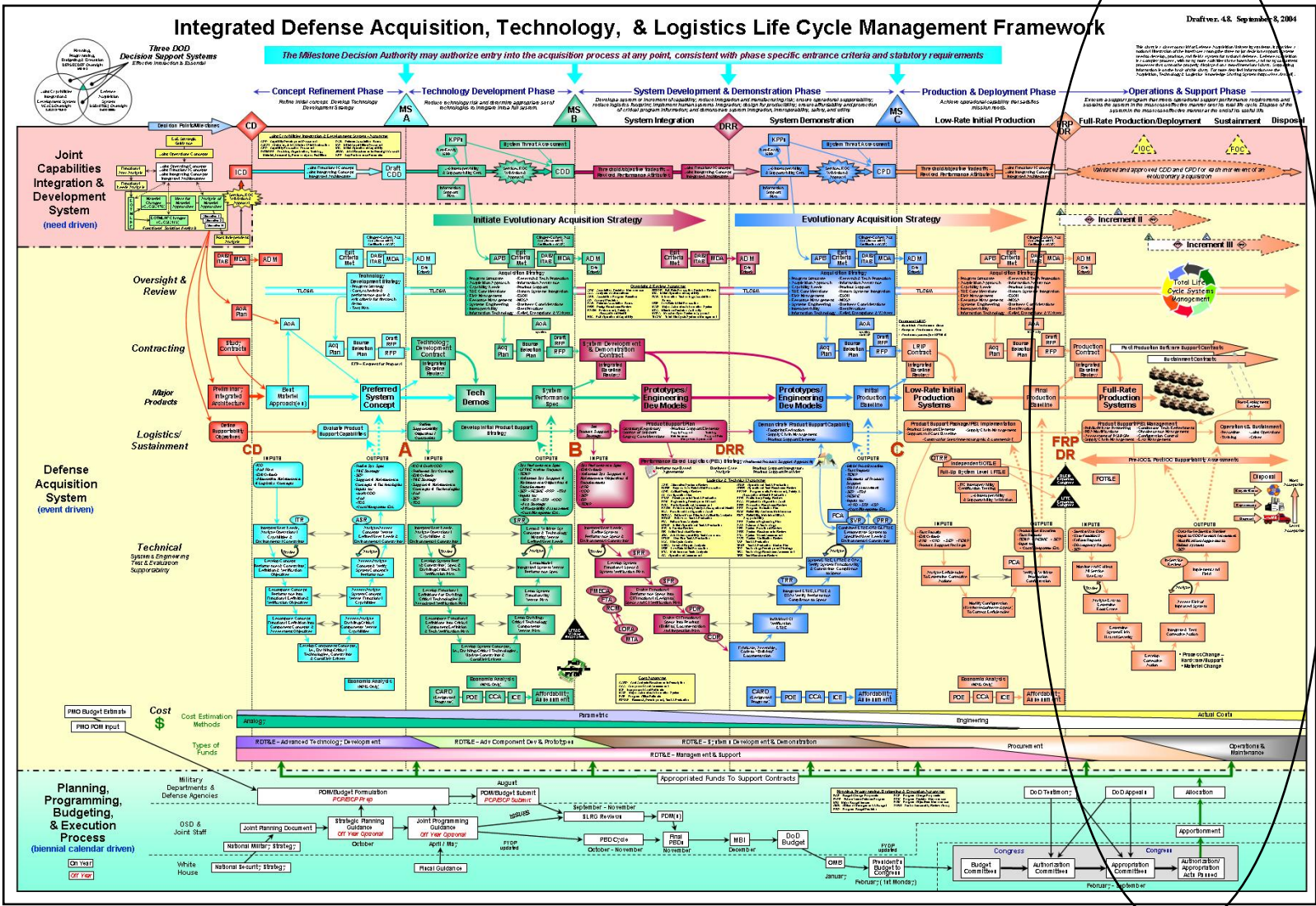
System Safety in SE Process Operations and Sustainment Phase

Inputs	System Safety Should:
Service Use Data	Review for system safety implications
User Feedback	Review for system safety implications
Failure Reports	1. Review Follow-On Operational Test & Evaluation (FOT&E) results for system safety implications 2. Review failure/mishap reports for causal factors or mitigation failures and recommend alternative mitigation measures 3. Assist in mishap investigations as requested
Discrepancy Reports	Review discrepancy reports for system safety implications
Systems Engineering Plan (SEP)	1. Update strategy for integrating ESOH risk management into SE 2. Identify applicable safety boards and process for concurrence/approval

How the ATP Task Force Has Responded (con't)

- **Incorporated ESOH into *Defense Acquisition Guidebook***

  - **Programmatic ESOH evaluation (PESHE)**

  - **ESOH risk management process**

- **Developed Defense Acquisition University continuous learning course, "System Safety in Systems Engineering" (CLE009)**

  - **Based on use of MIL-STD-882D**

  - **Provides roadmap for linking System Safety into SE process**

  - **Maps System Safety tasks into SE process for each phase**

How the ATP Task Force Has Responded (con't)

- **Formed NDIA Systems Engineering Division System Safety Committee in December 2004**
  - **Industry and government partnership to ensure continuous improvement of the integration of System Safety into SE**
- **Outreach**
  - **2004 NDIA SE Conference**
  - **2004 DoD Program Executive Officer/Systems Command (PEO/SYSCOM) Conference**
  - **2005 Defense Standardization Program Conference**
  - **2005 Joint Services Environmental Management Conference**
  - **2005 INCOSE Conference**
  - ***2005 International System Safety Conference***
  - **2005 NDIA SE Conference**
  - **2005 PEOSYSCOM Conference**
  - **2006 Defense Standardization Program Conference**
  - **2006 Joint Services Environmental Management Conference**

Safety and the Joint Warfighting Environment

- **Individual Services have long-standing, thorough, Service-specific weapon safety review processes to meet their unique requirements (philosophies, warfighting needs, definition of what is "safe")**

  - Army: Materiel release process, Fuze Safety Review Board, Ignition System Safety Review Board

  - Navy/Marine Corps: Weapon System Explosives Safety Review Board, Laser Safety Review Board

  - Air Force: Non-Nuclear Munitions Safety Board, Laser Safety Review Board

Existing Safety review process is not supportive of Joint warfighting requirements

Summary

- **OSD's fundamental role is to set policy, provide relevant and effective education and training, and foster communication throughout the community**

- **OSD cannot do everything…NOR should we**

- **Challenges Remain**

  - **Refocusing Acquirer and Supplier on technical management of programs throughout the life cycle**

  - **Getting System Safety fully and effectively integrated into the Systems Engineering process to reduce Environment, Safety, and Occupational Health risks & costs**

You Can't Be Too Safe…or Can You?